

APPLICATION FOR UNITED STATES LETTERS PATENT

INK BASE FOR PIGMENTED INKS, INKS MANUFACTURED  
THEREFROM AND THEIR USE

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The invention relates to an ink base for pigmented inks, inks made therefrom, as well as their use for printing, in particular, for use in ink-jet systems or other machine-based writing, printing, drawing or marking methods.

### 2. Description of the Related Art

Pigmented inks having a water-base and their use for inkjet printers are known in principle. Such inks according to the prior art are comprised of water, pigments as color-providing agents, drying retarders, and optionally other additives such as, for example, polymers, emulsifiers, preservatives, and surfactants. Drying retarders in inks according to the prior art, inter alia, are often, for example, glycols, glycerin, and pyrrolidones as well as mixtures of the these drying retarders.

In the following table, some examples of drying retarders used in such pigmented inks as well as their proportion in the ink in weight % (% by wt.) are listed.

Ink	Drying Retarder
yellow ink	3.1 % ethylene glycol 1.2 % diethylene glycol 3.9 % 2-pyrrolidone 10.1 % glycerine 6.8 % butyl triglycol
red ink (magenta)	11.2 % ethylene glycol 3.1 % 2-pyrrolidone 26.7 % glycerine 6.7 % butyl triglycol
blue ink (cyan)	7.8 % ethylene glycol 2.0 % 2-pyrrolidone 12.0 % glycerine 12.8 % butyl triglycol
black ink	0.2 % 1,2-propane diol 0.3 % diethylene glycol 2.1 % 2-pyrrolidone 11.1 % glycerine 4.3 % triethylene glycol 13.6 % butyl diglycol

A disadvantage of such ink compositions is that such pigmented inks have a tendency to dry within the printing jets, to a substantially higher degree in comparison to, for example, the dye-based inks. Because of this, reliability

cannot be ensured due to plugged and dried-up jets; this is manifested preliminarily already by an unsatisfactory printing quality. For this reason, it has been attempted to compensate this disadvantage by increasing the proportion of the drying retarder; however, this, in turn, also leads to disadvantages. In particular in the case of fast printers and when using inexpensive printing media in combination with inks having a high contents of drying retarders, this results in unsatisfactory contour sharpness and surface coverage. As a result of the increased drying time, the probability of smudging during printing and during removal from the printer is extremely high.

Moreover, the manufacturing costs of such inks according to the prior art are very high.

### SUMMARY OF THE INVENTION

It is an object of the present invention to provide an ink base for pigmented inks, in particular, pigmented inks for inkjet printing, which ink base does not have the aforementioned disadvantages and, in particular, does not have the tendency of drying on the jets but still enables short drying times on the printing medium, provides a qualitatively excellent printing image, in particular, high contour sharpness and uniform surfaces. The term uniform surfaces is to be understood in that the inks should spread easily but should not bleed at the color contours. When using the ink base according to the invention as well as the inks manufactured therefrom, a high printing reliability should be ensured. Moreover, the ink base as well as the inks should be producible inexpensively and should be usable as universally as possible on all printing media and in connection with different printers and printing systems.

In accordance with the present invention, this is achieved in that:

- the drying retarder is comprised at least of diethylene glycol (DR1), 1,6-hexane diol (DR2), and pentaerythritol (DR3);
- the ink base comprises at least

diethylene glycol (DR1)	30.0 - 95.5 % by wt.
1,6-hexane diol (DR2)	3.0 - 40.0 % by wt.
pentaerythritol (DR3)	0.01 - 3.0 % by wt.
and	
amine(s) (PH)	1.5 -15.0 % by wt.;

and

- the pH adjusting agent (PH) is an amine or a mixture of several amines.

The invention is furthermore solved in that the ink is comprised of:

20.0 - 95.0 % by wt.	water (bidistilled) (SOL),
0.1 - 40.0 % by wt.	pigment preparation (COA),
0.1 - 10.0 % by wt.	triethanolamine (PH),
0.01 - 2.0 % by wt.	pentaerythritol (DR3),
0.5 - 10.0 % by wt.	1,6-hexane diol (DR2),
0.2 - 30.0 % by wt.	diethylene glycol (DR1),
0 - 20.0 % by wt.	polymer dispersion (BM),
0.01 - 0.5 % by wt.	preservative (PS),
0 - 2.0 % by wt.	surfactant (SF), and
0 - 30.0 % by wt.	additional drying retarders (ADR).

It was found to be particularly advantageous that, when employing the ink according to the present invention and the

inks manufactured therefrom, drying of ink on the jets of the print heads can be reliably prevented but, on the other hand, the drying time, even for fast printers, on almost any print medium is so short that smudging in the printer or during removal from the printer can be reliably prevented.

With minimal device-specific modifications, the ink base according to the invention can be used universally in different printers so that costs in regard to development, production, storage, and logistics can be saved.

The object is solved in that an ink base for pigmented inks has been found which is comprised of a special combination of drying retarders (DR) and amines (PH).

The drying retarders (DR) according to the invention are a combination of diethylene glycol (DR1), 1,6-hexane diol (DR2), and pentaerythritol (DR3). These drying retarders are water-soluble and non-toxic substances.

Additional drying retarders (ADR) can be added in addition to the inventively employed drying retarders (DR).

The ink base according to the invention furthermore comprises amines for adjusting the pH value. By means of the

amines (PH), the ink base and the inks produced therefrom become basic so that, additionally, the wear on the print head is minimized and the service life of the ink conduit system is increased.

Moreover, it was found that the ink base and the inks produced therefrom have a substantially improved storage stability within the basic pH range.

Examples of amines (PH) are ethanol amine, triethanolamine, ammonia, and dimethyl ethanolamine as well as mixtures of the aforementioned amines (PH).

By means of the claimed combination, comprised of special drying retarders (DR) and at least one amine (PH), the initial writing behavior after extended printer downtimes is significantly improved. Not only after printer downtimes but also during the printing process, when individual colors are not required or used during a certain printing duration, a significant improvement in the initial printing behavior is observed.



### DESCRIPTION OF THE PREFERRED EMBODIMENTS

For explaining the invention in more detail, the following boundary example of an ink base is provided:

DR1	diethylene glycol	30.0 - 95.5 % by wt.
DR2	1,6-hexane diol	3.0 - 40.0 % by wt.
DR3	pentaerythritol	0.01 - 3.0 % by wt.
PH	amines	1.5 - 15.0 % by wt.

A compositional example for an ink base according to the invention is as follows:

diethylene glycol	74.40 % by wt.
1,6-hexane diol	20.70 % by wt.
pentaerythritol	0.03 % by wt.
amines	4.97 % by wt.

The amines (PH) used in the ink base can be described by the general formula  $N(R_1 R_2 R_3)$ , wherein the free radicals  $R_1$ ,  $R_2$ ,  $R_3$ , independent from one another, can be hydrogen (H), a dimethyl group ( $CH_3$ ) or an ethyl group ( $CH_2CH_3$ ).

In the following, in order to provide further explanations, a boundary example as well as several specific ink compositions are listed which are made by employing the

ink base according to the invention.

Boundary Example: Inks for Inkjet Printing

water (bidistilled)	SOL	20.0 - 95.0 % by wt.
pigment preparation	COA	0.1 - 40.0 % by wt.
triethanolamine	PH	0.1 - 10.0 % by wt.
pentaerythritol	DR3	0.01 - 2.0 % by wt.
1,6-hexane diol	DR2	0.5 - 10.0 % by wt.
diethylene glycol	DR1	0.2 - 30.0 % by wt.
polymer dispersion	BM	0 - 20.0 % by wt.
preservative	PS	0.01 - 0.5 % by wt.
surfactant	SF	0 - 2.0 % by wt.
addit. drying retarders	ADR	0 - 30.0 % by wt.

Compositional Example 1:

water (bidistilled)	SOL	62.1 % by wt.
pigment preparation	COA	11.5 % by wt.
triethanolamine	PH	0.8 % by wt.
pentaerythritol	DR3	0.05 % by wt.
1,6-hexane diol	DR2	3.35 % by wt.
diethylene glycol	DR1	12.0 % by wt.
acrylate dispersion	BM	2.0 % by wt.
butyl diglycol	ADR	8.0 % by wt.
preservative	PS	0.2 % by wt.

Compositional Example 2:

water (bidistilled)	SOL	53.1 % by wt.
pigment preparation	COA	25.0 % by wt.
triethanolamine	PH	0.8 % by wt.
pentaerythritol	DR3	0.01 % by wt.
1,6-hexane diol	DR2	0.67 % by wt.
diethylene glycol	DR1	20.2 % by wt.
urethane dispersion	BM	2.0 % by wt.
isothiazolinone derivatives		
	PS	0.15 % by wt.

Compositional Example 3:

water (deionized)	SOL	68.8 % by wt.
pigment preparation	COA	9.0 % by wt.
triethanolamine	PH	1.0 % by wt.
pentaerythritol	DR3	0.01 % by wt.
1,6-hexane diol	DR2	0.67 % by wt.
diethylene glycol	DR1	20.2 % by wt.
preservative	PS	0.2 % by wt.
surfactant	SF	0.1 % by wt.

Compositional Example 4: Blue Ink

water (bidistilled)	SOL	76.1 % by wt.
pigment preparation	COA	1.8 % by wt.
triethanolamine	PH	1.0 % by wt.

pentaerythritol	DR3	0.02 % by wt.
1,6-hexane diol	DR2	0.67 % by wt.
diethylene glycol	DR1	20.2 % by wt.
preservative	PS	0.15 % by wt.
fatty acid alcohol polyglycol ether	SF	0.1 % by wt.

The ink base and the inks produced therefrom can optionally contain additional additives or auxiliary agents. Polymers (BM) in dissolved or dispersed form can be contained as additives. Examples of such polymers (BM) are for example acrylate and urethane.

Additional conventional additives that are optionally contained in the inks according to the invention are, for example, surfactants (SF), preservatives (PS), emulsifiers, and spreading agents.

As coloring (color-providing) agents (COA) pigments or pigment preparations are used that are essentially salt-free. There are no limits in regard to employing pigments.

A cost reduction when producing ready-for-use inks can be achieved in that the proportion of cost-intensive chemicals such as drying retarders (DR) is kept as small as

possible without this reducing the ink quality or negatively affecting the solution to the object of the invention.

Preservatives (PS) can be added already to the ink base, if needed. Examples of preservatives (PS) are solutions of isothiazolinone derivative, O-acetales and N-acetales, halogenated acid amide derivatives and/or N-heterocyclic, S-heterocyclic compounds.

The inventive ink base or the inks produced therefrom are used for printing, in particular, for printing with inkjet systems or other machine-based writing, printing, drawing or marking methods. The inks are comprised substantially of the ink base, coloring agents (COA), and water (SOL) as well as optionally other additives.

While specific embodiments of the invention have been shown and described in detail to illustrate the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.